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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/653,192	09/03/2003	Hyeong-Gon Noh	1567.1053	1737
49455	7590	02/01/2006	EXAMINER	
STEIN, MCEWEN & BUI, LLP 1400 EYE STREET, NW SUITE 300 WASHINGTON, DC 20005				WEINER, LAURA S
ART UNIT		PAPER NUMBER		
1745				

DATE MAILED: 02/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/653,192	NOH ET AL.	
	Examiner	Art Unit	
	Laura S. Weiner	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 21 December 2005.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-63 is/are pending in the application.
- 4a) Of the above claim(s) 13-16, 23-28, 31 and 43-63 is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-12, 17-20, 29-30, 32-35, 38-42 is/are rejected.
- 7) Claim(s) 21, 22, 36 and 37 is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>9-03; 5-04; 9-05</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input checked="" type="checkbox"/> Other: <u>Exhibit A and B</u> . |

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1-28, 38-42 in the reply filed on 12-21-05 is acknowledged. Also, Group II, claims 29-37 has been combined because the claims are drawn to the elected species. The traversal is on the ground(s) that claims 13-16 and 23-28, 38-63 are so closely related to elected claims 1-12 and 17-22 therefore should remain in the same application and that the electrolyte, the battery and the method of preparing an electrolyte would not be a burden to search. This is not found persuasive because Group I, claims 1-28, 38-42 (and group II, claims 19-37), drawn to an electrolyte comprising an organic solvent with a high boiling point and a carbonate-based additive, classified in class 429, subclass 307 is very different from Group III, claims 43-44, drawn to an electrolyte comprising a mixed solvent comprising GBL/EC/EMC/DMC /fluorobenzene, classified in class 429, subclass 330; Group IV, claim 45, drawn to a method of preparing an electrolyte, classified in class 429, subclass 188; Group V, claim 46, drawn to a method of preparing a secondary battery, classified in class 29, subclass 623.1 and Group VI, claims 47-63, drawn to an electrolyte comprising a mixture of GBL, a carbonate-based additive and an organic sulfone-based compound, classified in class 429, subclass 338.

As stated previously, the inventions are distinct, each from the other because of the following reasons: Invention I is unrelated to Inventions III and VI. These inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects

(MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions are not disclosed as capable of use together and different effects such that Invention I requires additional solvents such as organic solvent with a low boiling point or an aromatic hydrocarbon organic solvent or the compound cited as Formula (4) or a swelling-inhibiting additive which is not required in the other groups; Group III requires a mixed solvent comprising GBL/EC/EMC/DMC/fluorobenzene which is not required in Group I and Group VI requires a mixed solvent of GBL and an organic sulfone-based compound which is not required in Group I.

2. Invention I is unrelated to Inventions IV and V. These inventions are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the process as claimed can be used to make other and materially different product such as the products of Inventions I, II, III or VI.

Therefore claims 43-63 are withdrawn.

In regard to claims 13-16 and 23-28, 31, these claims are still in the case but are withdrawn currently because they do not disclose the currently elected species of a carbonate-based additive compound having an halogen substituent where the electrolyte further comprises a methyl sulfone (*cannot be a vinyl sulfone because an alkenyl group cited in claim 17; C2-C4 alkenyl group of claim 18 and a halogen-*

substituted alkenyl group of claim 19 was not chosen], an organic sulfone-based compound of formula (3) (claims 1-12, 17-22) where R1 and R2 are a primary, secondary or tertiary alkyl group and more specifically C1-C4 alkyl and more specifically an halogen-substituted alkyl group.

Therefore, claims 13-14 are withdrawn because they contain an electrolyte further comprising an organic solvent with a low boiling point; claims 15-16 are withdrawn because they contain an electrolyte further comprising an aromatic hydrocarbon organic solvent; claims 23-26 are withdrawn because they contain an electrolyte further comprising a compound of formula (4); claims 27-28 are withdrawn because they contain an electrolyte further comprising a swelling-inhibiting additive and claim 31 requires R1 or R2 of the sulfone-based compound to be a vinyl.

The requirement is still deemed proper and is therefore made FINAL.

3. Claims 13-16, 23-28, 43-63 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention and species, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 12-21-05.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-12, 38-42 are rejected under 35 U.S.C. 102(e) as being anticipated by Sato et al. (US 2004/0146786).

Sato et al. teaches on page 18, a nonaqueous electrolyte comprising 0.01-7 wt% of at least one compound selected from Compound (A) where (A) can be fluoroethylene carbonate (A12), an ion-conductive salt and an organic electrolyte (C). Sato et al. teaches on page 15, Example 2, that the electrolyte comprises PC (bp= 212 or 240 degrees C), ethylene carbonate (bp= 238 or 248 degrees C) and DEC and 1 M LiPF6. Sato et al. teaches on page 11, [0181], that the positive electrode comprises LiMnO₂, LiMn₂O₄, etc. and teaches on page 12, [0186, 0188], that the negative electrode comprises carbonaceous materials which include graphite, carbon black, etc.

6. Claims 1-4, 7-8, 38, 40-42 are rejected under 35 U.S.C. 102(b) as being anticipated by Arai et al. (JP 10-189043, abstract).

Arai et al. teaches a battery comprising a nonaqueous solvent composed of 5-40 wt% of a chain carbonate and a mono-halogenated cyclic carbonate expressed by formula I where X1 to X4 are F, Cl, Br and H. Arai et al. teaches on page 2 of the patent that the electrolyte comprises LiPF6, LiBF4, etc. Arai et al. teaches on page 7 of the patent that the electrolyte comprises DMC (bp = 91 degrees C). Arai et al. teaches

that the positive electrode comprises LiCoO₂ and the negative electrode comprises graphite..

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1-4, 7-12, 17-20, 29-30, 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (6,743,947) in view of Arai et al. (6,495,293).

Xu et al. teaches in columns 13-14, claim 4, that the electrolytic solvent is selected from the group of nonaqueous aprotic compounds consisting of AN, ADN, butylene carbonate, diethylcarbonate, dimethylcarbonate, ethylmethylcarbonate, ethylene carbonate, propylene carbonate fluoroethylene carbonate, difluoroethylene carbonate, dialkylsulfone (R-SO₂-R'), etc. and teaches in claim 5, that the electrolytic solvent is a mixture of two or more of the solvents of claim 4.

Xu et al. teaches the claimed invention as explained above teaching that the electrolyte salt is an onium salt instead of a lithium salt and does not specifically teach that the electrolyte can comprise butylene carbonate, ethylene carbonate or propylene carbonate as well as difluoroethylene carbonate as well as dialkylsulfone.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use three solvents such as EC, difluoroethylene and

dialkylsulfone because Xu et al. teaches that a mixture of two or more solvents is known and because it is *prima facie* obvious to combine two compositions each of which is taught by prior art to be useful for the same purpose in order to form a third composition that is to be used for the very same purpose. See *In re Kerkhoven*, 205 USPQ 1069; *In re Susi*, 169 USPQ 423.

Arai et al. teaches in column 2, lines 15-42, a nonaqueous electrolyte comprising a fluorinated solvent where if a lithium salt is used, the electrolyte can be used as the electrolyte for a lithium battery and if a quaternary onium salt is used, the electrolyte can be used as an electrolyte for electrochemical capacitors. Arai et al. teaches in column 4, that the lithium salt for a lithium battery can be LiPF₆, LiBF₄, etc.

It would have been obvious to one having ordinary skill in the art at the time the invention was made use a lithium salt instead of an onium salt when the electrochemical cell is a lithium battery because Arai teaches that if a lithium salt is used, the electrolyte can be used as the electrolyte for a lithium battery and if a quaternary onium salt is used, the electrolyte can be used as an electrolyte for electrochemical capacitors.

Claim Rejections - 35 USC § 112

9. Claims 9-12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 9-12 are rejected because it is unclear what is meant by "a high boiling point" because claims 9-11 claim a range of 100-200 degrees C. For example DEC has

a boiling point of 126 degrees C and MEC has a boiling point of 108 degrees C but they are not considered "organic solvent with a high boiling point". These solvents have boiling points higher than 100 degrees C which is claimed in claim 9.

Claim 12 is rejected because it is unclear why PC and BC are not being claimed when EC is claimed. As seen from Exhibit A and Exhibit B, the boiling point (degrees C) of EC =238 or 248; PC=212 or 240; BC= 240. PC and BC both have boiling points higher than 100 degrees C as cited in claim 9; higher than 150 degrees C as cited in claim 10 and higher than 200 degrees C as stated in claim 11.

Allowable Subject Matter

10. Claims 21-22, 36-37 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura S. Weiner whose telephone number is 571-272-1294. The examiner can normally be reached on M-F (6:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Laura S. Weiner
Primary Examiner
Art Unit 1745

January 26, 2006

Exhibit A

Solvent	ϵr	γ (kPa)	DN	mp (°C)	bp (°C)	E_{red}/E_{ox} (V vs. SCE)
Ethylene carbonate (EC)	90	1.9 (40°C)	16.4	37	238	-3.0 +3.2
Propylene carbonate (PC)	65	2.5	15.1	-19	212	-3.0 +3.6
Butylene carbonate (BC)	53	1.2	-	-53	240	-3.0 +4.2
γ -Bulyrolactone (GBL)	42	1.7	18	-44	204	-3.0 +5.2
1, 2-Dimethoxyethane (DME)	7.2	0.46	20	-58	84	-3.0 +2.1
Tetrahydrofuran	7.4	0.46	20.0	-103	66	-3.0 +2.2
2-Methyltetrahydrofuran (2 MeTHF)	6.2	0.47	18	-137	30	-3.0 +2.2
1, 3-Dioxolane (DOL)	7.1	0.59	-	-95	78	-3.0 +2.2
4-Methyl-1, 3-dioxolane (4MeDOL)	6.8	0.60	-	-125	85	-3.0 +2.2
Methyl formate	8.5	0.33	-	-99	32	-2.5 +2.3
Methyl acetate	6.7	0.37	16.5	-98	58	-2.9 +3.4
Methyl propionate	6.2	0.43	-	-88	79	-2.5 +3.4
Dimethyl carbonate (DMC)	3.1	0.59	-	3	90	-3.0 +3.7
Ethyl methyl carbonate (EMC)	2.9	0.65	-	-55	108	-3.0 +3.7
Diethyl carbonate (DEC)	2.8	0.75	15.1	-43	127	-3.0 +3.7

C W 70
Exhibit B

TABLE 36.8 Characteristics of Organic Solvents*

Characteristic	γ_{BL}	THF	1,2-DME	PC	EC	DMC	DEC	DEE	Dioxolane
Structural formula	$\begin{array}{c} \text{CH}_2-\text{CH}_2 \\ \\ \text{CH}_2-\text{C=O} \\ \\ \text{O} \end{array}$	$\begin{array}{c} \text{CH}_2-\text{CH}_2 \\ \\ \text{CH}_2-\text{O} \end{array}$	$\begin{array}{c} \text{CH}_2-\text{O}-\text{CH}_3 \\ \\ \text{CH}_2-\text{O}-\text{CH}_3 \end{array}$	$\begin{array}{c} \text{O} \\ \\ \text{C} \\ \\ \text{O} \\ \\ \text{CH}_2-\text{CH} \\ \\ \text{CH}_3 \end{array}$	$\begin{array}{c} \text{O} \\ \\ \text{C} \\ \\ \text{O} \\ \\ \text{CH}_2-\text{CH}_2 \end{array}$	$\begin{array}{c} \text{O} \\ \\ \text{C} \\ \\ \text{O} \\ \\ \text{CH}_3 \end{array}$	$\begin{array}{c} \text{O} \\ \\ \text{C} \\ \\ \text{O} \\ \\ \text{CH}_2 \\ \\ \text{CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_2-\text{O}-\text{C}_2\text{H}_5 \\ \\ \text{CH}_2-\text{O}-\text{C}_2\text{H}_5 \end{array}$	$\begin{array}{c} \text{H}_2 \\ \\ \text{C} \\ \\ \text{O} \\ \\ \text{CH}_2-\text{CH}_2 \end{array}$
Boiling temperature, °C	202–204	65–67	85	240	248	91	126	121	78
Melting temperature, °C	-43	-109	-58	-49	-39–40	4.6	-43	-74	-95
Density, g/cm³	1.13	0.887	0.866	1.198	1.322	1.071	0.98	0.842	1.060
Solution conductivity, S/cm	1.1×10^{-8}	2.1×10^{-7}	3.2×10^{-8}	2.1×10^{-9}	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$	$<10^{-7}$
Viscosity at 25°C, cP	1.75	0.48	0.455	2.5	1.86 (at 40°C)	0.59	0.75	0.65	0.58
Dielectric constant at 20°C	39	7.75	7.20	64.4	89.6 (at 40°C)	3.12	2.82	5.1	6.79
Molecular weight	86.09	72.10	90.12	102.0	88.1	90.08	118.13	118.18	74.1
H₂O content, ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10
Electrolytic conductivity at 20°C, 1M LiAsF₆, mS/cm	10.62	12.87	19.40	5.28	6.97	11.00 (1.9 mol)	5.00 (1.5 mol)	~10.00†	~11.20†

* γ_{BL} = γ -butyrolactone; THF = tetrahydrofuran; 1,2-DME = 1,2-dimethoxyethane; PC = propylene carbonate; EC = ethylene carbonate; DMC = dimethyl carbonate; DEC = diethyl carbonate; DEE = diethoxyethane.

† Estimation based on Walden's rule.

SOURCE: From Ref. 8.

TABLE 36.9 Ionic Conductivity of Some Organic Liquid Electrolytes (1M) Used in Secondary Lithium Battery Systems

Salt	Solvents	Solvent, vol %	Conductivities at °C, mS/cm								References
			-40	-20	-0	20	40	60	80		
LiPF ₆	EC/PC	50/50	0.23	1.36	3.45	6.56	10.34	14.63	19.35	*	
	2-MeTHF/EC/PC	75/12.5/12.5	2.43	4.46	6.75	9.24	11.64	14.00	16.22	*	
	EC/DMC	33/67	—	1.2	5.0	10.0	—	20.0	—	†	
	EC/DME	33/67	—	8.0	13.6	18.1	25.2	31.9	—	‡	
	EC/DEC	33/67	—	2.5	4.4	7.0	9.7	12.9	—	‡	
LiASF ₆	EC/DME	50/50	Freeze	5.27	9.50	14.52	20.64	26.65	32.57	*	
	PC/DME	50/50	Freeze	4.43	8.37	13.15	18.46	23.92	28.18	*	
	2-MeTHF/EC/PC	75/12.5/12.5	2.54	4.67	6.91	9.90	12.76	15.52	18.18	*	
LiCF ₃ SO ₃	EC/PC	50/50	0.02	0.55	1.24	2.22	3.45	4.88	6.43	*	
	DME/PC	50/50	—	2.61	4.17	5.88	7.46	9.07	10.61	*	
	DME/PC	50/50	—	—	5.32	7.41	9.43	11.44	13.20	*	
	2-MeTHF/EC/PC	75/12.5/12.5	0.50	0.93	1.34	1.78	2.31	2.81	3.30	*	
LiN(CF ₃ SO ₂) ₃	EC/PC	50/50	0.28	1.21	2.80	5.12	7.69	10.70	13.86	*	
	EC/DME	50/50	—	—	7.87	12.08	16.58	21.25	25.97	*	
	PC/DME	50/50	—	3.92	7.19	11.23	15.51	19.88	24.30	*	
	2-MeTHF/EC/PC	75/12.5/12.5	2.07	3.40	5.12	7.06	8.71	10.41	12.02	*	
LiBF ₆	EC/PC	50/50	0.19	1.11	2.41	4.25	6.27	8.51	10.79	*	
	2-MeTHF/EC/PC	75/12.5/12.5	0.38	0.92	1.64	2.53	3.43	4.29	—		
	EC/DMC	33/67	—	1.3	3.5	4.9	6.4	7.8	—	‡	
	EC/DEC	33/67	—	1.2	2.0	3.2	4.4	5.5	—	‡	
	EC/DME	33/67	—	6.7	9.9	12.7	15.6	18.5	—	‡	
LiClO ₄	EC/DMC	33/67	—	1.0	5.7	8.4	11.0	13.9	—	‡	
	EC/DEC	33/67	—	1.8	3.5	5.2	7.3	9.4	—	‡	
	EC/DME	33/67	—	8.4	12.3	16.5	20.3	23.9	—	‡	

* J. T. Dudley et al., *J. Power Sources*, 35:59–82, 1991.

† D. Guyomard and J. M. Tarascon, *J. Electrochem. Soc.*, 140:3071–3081, 1993.

‡ S. Danahay and S. Hossain, unpublished results, Yardney Technical Products, Inc.